APPARATUS FOR REMOVING HEAVY DUTY BRAKE DRUM BOLTS

Field of the Invention

The present invention relates to an apparatus for aiding in the removal of brake drum bolts from truck and trailer wheels, and more particularly, an apparatus that allows a user to secure a nut to a brake drum bolt on one side of a truck and trailer wheel while loosening the brake drum bolt from the opposite side of the wheel.

Background of the Invention

As a mechanic, performing service on large heavy duty truck and trailer wheels can be difficult. The sheer size of such wheels makes working with and handling the wheels cumbersome and tiring. This difficulty may be compounded when dual wheels are utilized for certain truck and trailer applications. The dual wheels provide a set of wheels that are more than twice as wide as a single wheel.

Heavy duty truck and trailer wheels generally comprise a rubber tire mounted on a steel rim. An apparatus called a spider is bolted to the rim. The spider provides equally spaced legs that extend radially outward from the center-line axis of the wheel. A web extends between each of the legs. The spider has an aperture coaxially aligned with the center-line axis of the wheel in order to allow for the axle of the truck or trailer to extend therethrough. A brake drum attaches to the spider via bolts, and the bolts extend through the webs of the spider and into the brake drum. Brake shoes are mounted to the axle of the truck or trailer

and engage the brake drum to slow down and stop the truck and trailer.

When servicing the brakes on a heavy duty truck and/or trailer, it is often necessary to remove the brake drum. To accomplish this, the brake drum bolts must be loosened and removed in order that the brake drum may be disconnected from the spider. Since the brake drum bolts utilize a threaded bolt and a nut, it is necessary to secure the nut on one side of the wheel while loosening the bolt on the opposite side of the wheel. To accomplish this task, the mechanic must reach around both sides of the tire(s) to secure a socket on the nut while ratcheting the bolt loose from the nut. This is a cumbersome and difficult task when handling one wheel, however, it becomes even a more difficult task when handling dual wheels. Therefore, it is sometimes necessary to utilize two mechanics to remove the brake drum bolts from the truck and trailer wheels.

Other attempts have been made to secure the nut on the back side of the wheel while ratcheting the bolt from the front side of the wheel. Vice grips, pliers, wrenches, and other tools have been utilized in an attempt to secure the nut without having a mechanic hold onto the tools. However, upon ratcheting the nut from the opposite side of the wheel, the vibration shakes such tools loose from the nut, thereby preventing the tool from stopping the nut from rotating.

It would be desirable to provide an inexpensive and simple tool that would allow a mechanic to easily and quickly remove brake drum bolts from heavy duty truck and trailer wheels without the aid of a second mechanic. It would also be desirable to provide a tool for removing brake drum bolts from a heavy duty truck or trailer that could be utilized on various size truck and trailer wheels.

Summary of the Invention

The present invention relates to a tooling apparatus for aiding in the removal of brake drum bolts on heavy duty truck and trailer wheels. The present invention provides an elongated primary shaft having a first end and a second end, wherein an intermediate shaft is connected to the second end of the primary shaft. A secondary shaft is connected to the intermediate shaft and provides a socket end adaptable to receive a socket for engaging the brake drum bolts. A bearing member is adjustably connected to the primary shaft and is adaptable to engage a hole in the wheel for securing the position of the socket on the brake drum bolts. The bearing member may have a frusto-conical configuration for engaging the hole in the wheel and may threadably engage the primary shaft to allow for the adjustment of the bearing member along the longitudinal axis of the primary shaft. At least one jam nut threadably engages the primary shaft and cooperatively engages the bearing member to secure the bearing member in a predetermined position along the primary shaft. The primary shaft may also have a knurled portion formed therein for forming a handle on the first end of the primary shaft. In one embodiment, the primary shaft, intermediate shaft, and secondary shaft may be integrally fabricated.

The present invention also provides various embodiments for adjusting the size of the tooling apparatus. In a second embodiment, the first end and the second end of the primary shaft are releasably connected to one another. In a third embodiment, the intermediate shaft may be adjustably connected to the primary shaft, and the secondary shaft may be adjustably connected to the intermediate shaft. Jam nuts may be utilized on the intermediate shaft and the secondary shaft to secure the positions of the intermediate shaft and the secondary shaft. In a fourth embodiment, the primary shaft may have an aperture and key way formed therein

for receiving the intermediate shaft. The intermediate shaft may have a key formed therein for cooperatively engaging the aperture in the key way of the primary shaft. In a fifth embodiment, the primary shaft may have a substantially rectangular throughbore, and the intermediate shaft may have a substantially rectangular cross section wherein the primary shaft receives the intermediate shaft through the throughbore. A set screw threadably engages an aperture in the primary shaft wherein the set screw extends into the throughbore for engaging the intermediate shaft in a predetermined position relative to the primary shaft.

In a sixth embodiment, a plurality of intermediate and secondary shafts are mounted to a primary shaft in order to secure a plurality of brake drum bolts at one time.

In a seventh embodiment, the intermediate shaft may have a throughbore for receiving the secondary shaft and allowing the secondary shaft to rotate with the socket to properly engage the brake drum bolts. A stop may be formed on the intermediate shaft, and the secondary shaft may have a radially-extending portion wherein the radially-extending portion engages the stop to limit the rotational adjustment of the secondary shaft.

Brief Description of the Drawings

The description herein makes reference to the accompanying drawings wherein like referenced numerals refer to like parts throughout several views and wherein:

Fig. 1 is a perspective view of the tooling apparatus of the present invention being utilized on heavy duty truck and trailer wheels.

Fig. 2 is a perspective view showing a first embodiment of the tooling apparatus of the of the present invention.

Fig. 3 is an exploded view of a second embodiment of the tooling apparatus of the

present invention.

Fig. 4 is a front view showing a fourth embodiment of the tooling apparatus of the present invention.

Fig. 5 is a front view showing a fifth embodiment of the tooling apparatus of the present invention.

Fig. 6 is a sectional view in the direction of arrows 6-6 in Fig. 5 showing the adjustable key way connection between the intermediate shaft and the primary shaft of the tooling apparatus of the present invention.

Fig. 7 is a front view showing a sixth embodiment of the tooling apparatus of the present invention.

Fig. 8 is a cross-sectional view shown in the direction of arrow 8-8 in Fig. 7 showing a substantially rectangular throughbore connection of the intermediate shaft and the primary shaft of the tooling apparatus of the present invention.

Fig. 9 is a sixth embodiment of the tooling apparatus of the present invention showing a plurality of intermediate shafts and secondary shafts connected to a primary shaft.

Fig. 10 is a seventh embodiment showing a rotational adjustment of the socket end of the tooling apparatus of the present invention..

Fig. 11 is a partial top plan view of the tooling apparatus of the present invention shown in Fig. 10.

Description of the Preferred Embodiment

Referring to the drawings, the present invention will now be described in detail with reference to the disclosed embodiment.

Fig. 1-2 illustrate a tooling apparatus **10** for aiding in the removal of brake drum bolts **12** on heavy duty truck or trailer wheels **14**. The heavy duty truck or trailer wheels **14** provide a rubber tire **16** mounted on a rim **18**. A brake drum **20** is mounted to a first side **22** of the wheels **14** and is connected to a spider (not shown) on a second side **34** of the wheels **14**. The brake drum **20** is connected to the spider through five brake drum bolts **12**. The brake drum bolts **12** include a threaded bolt (not shown) and a threaded nut **15** threaded thereon. The spider is connected to the rim **18** of the wheel **14** through a set of fasteners (not shown). The tooling apparatus **10** has a primary shaft **26**, an intermediate shaft **28**, and a secondary shaft **30**. The primary shaft **26** extends through a hole **24** in the wheels **14** wherein the hole **24** is coaxially aligned with the center-line axis **17** of the wheels **14**. A handle portion **32** of the primary shaft **26** extends on the second side **34** of the wheels **14**, and the intermediate shaft **28**, the secondary shaft **30**, and a socket portion **33** of the primary shaft **26** are located on the first side **22** of the wheels **14**. A bearing member **36** engages the hole or bearing race **24** in the wheels **14** and stabilizes the tooling apparatus **10** relative to the brake drum bolts **12**. The bearing member **36** has a frusto-conical configuration so that the bearing member **36** may be wedged into the hole or bearing race **24** of the wheel **14**. The bearing member **36** may be fabricated from nylon or a similar material such as a polymer or hardened rubber. The bearing member **36** should be fabricated from a "soft" rigid material so as not to damage the bearing face **24**.

In order for the tooling apparatus **10** to engage the brake drum bolts **12**, the tooling apparatus **10** has a substantially J-shaped configuration, as seen in Fig. 2. The primary shaft **26** provides the longer leg of the J-shaped configuration and has a knurled portion **37** on the loose end of the primary shaft **26**. The knurled portion **37** provides a handle for a user to

engage the tooling apparatus **10**. The primary shaft **26** also has a threaded portion **38** extending along a substantially mid portion of the primary shaft **26**. The threaded portion **38** threadably engages a threaded aperture in the bearing member **36** to adjustably position the bearing member **36** along a longitudinal axis **40** of the primary shaft **26**. A pair of jam nuts **42** (only one shown) threadably engage the threaded portion **38** of the primary shaft **26** on each side of the bearing member **36** in order to secure the bearing member **36** in a predetermined position along the primary shaft **26** of the tooling apparatus **10**. A groove **44** may be formed in one end of the primary shaft **26** to allow a pair of pliers (not shown) to grip the primary shaft **26** when loosening or tightening the jam nuts **42**.

The intermediate shaft **28** is integral with and extends at a substantially right angle from the primary shaft **26** of the tooling apparatus **10**. The intermediate shaft **28** extends at a radial distance substantially equivalent to the distance between the center-line axis of the wheels **14** and the brake drum bolts **12**. The secondary shaft **30** is integral with and extends at a substantially right angle from the intermediate shaft **28** and is substantially parallel to and extends across from the primary shaft **26** of the tooling apparatus **10**. A loose end **49** of the secondary shaft **30** has a substantially square configuration with a spring detent **46** formed therein for receiving a socket **48**. The spring detent **46** may utilize a conventional design wherein common sockets **48** may be utilized to engage the nuts **15** of the brake drum bolts **12**.

Since the radial distance between the center-line axis of the wheels **14** and the brake drum bolts **12** may vary depending on the size of the wheels, the tooling apparatus **10** may provide certain adjustments to vary the size of the tooling apparatus **10**. As seen in Fig. 3, a second embodiment shows a primary shaft **50** having a socket portion **52** and a handle portion **54** that are releasably connected by a threaded stud **56** formed on the handle portion **54** of the

primary shaft **50**, and a threaded bore **58** formed in the socket portion **52** of the primary shaft **50** for receiving the threaded stud **56**. This releasable connection allows various-sized socket portions **52** to be threaded onto the same primary shaft **50** in the event that various-sized wheels **14** are experienced.

Instead of interchanging different sized socket portions **52** of the tooling apparatus **10**, the present invention provides that the intermediate shaft **28**, the secondary shaft **30**, and the primary shaft **26** of the tooling apparatus **10** may be adjustable with respect to one another. As seen in Fig. 4, the third embodiment of the present invention provides a primary shaft **60** having a T-shaped configuration. The longitudinal portion of the primary shaft **60** is similar to that disclosed in the first embodiment. The loose end of the primary shaft **60** has a knurled portion **37** to form a handle, and a mid portion of the primary shaft **60** has a threaded portion **38** for adjustably receiving the bearing member **36**, similar to those previously described. A pair of jam nuts **42** are threaded on the primary shaft **60** on opposite sides of the bearing member **36** to secure the bearing member **36** in a predetermined position relative to the primary shaft **60**. The lateral portion **62** of the T-shaped configuration of the primary shaft **60** has a threaded bore extending along a longitudinal axis of the lateral portion **62**. The longitudinal axis of the lateral portion **62** is substantially perpendicular to the longitudinal axis of the longitudinal portion of the primary shaft **60**. The threaded bore threadably receives an intermediate shaft **64** having threads formed thereon along the length of the intermediate shaft **64**. A pair of jam nuts **66** may be threaded onto the intermediate shaft **64** on opposite sides of the lateral portion **62** of the T-shaped configuration of the primary shaft **60** so as to secure the intermediate shaft **64** in a predetermined position relative to the primary shaft **60**.

The intermediate shaft **64** also provides an enlarged end **67** having a threaded bore

extending therethrough. The threaded bore has a longitudinal axis substantially perpendicular to the longitudinal axis of the intermediate shaft **64**. The threaded bore in the enlarged end **67** of the intermediate shaft **64** threadably receives a secondary shaft **68** wherein the secondary shaft **68** has threads formed along its outer diameter. A pair of jam nuts **70** may be threaded onto the secondary shaft **68** on both sides of the enlarged end **67** of the intermediate shaft **64** in order to secure the secondary shaft **68** in a predetermined position relative to the intermediate shaft **64**. The end of the secondary shaft **68** provides a substantially square configuration and a spring detent **46** formed therein for receiving a socket **48**, as previously described.

In yet another way to provide adjustment to the tooling apparatus **10**, Figs. 5-6 illustrate a fourth embodiment of the tooling apparatus **10**. A primary shaft **72** has the knurled portion **37** for forming the handle as previously described, and the bearing member **36** is threadably received on a threaded portion of the primary shaft **72**, as previously described. A pair of jam nuts **42** are utilized to lock the bearing member **36** into a predetermined position relative to the primary shaft **72**, as also previously described. The primary shaft **72** has a T-shaped configuration wherein a lateral portion **74** of the T-shaped configuration has a throughbore **76** with a key way slot **77** extending along a longitudinal axis of the lateral portion **74** and substantially perpendicular to the longitudinal axis of the primary shaft **72**. A slot **78** is also provided in a top portion of the lateral portion **74** whereby the slot **78** extends through to the bore **76**. The bore **76** is smooth for receiving a smooth intermediate shaft **80** having a key **81** formed therein. The key **81** of the intermediate shaft **80** complimentarily engages the key way slot **77** in the lateral position **74**. A fastener **82** threadably engages a pair of apertures provided in the top portion of the lateral portion **74** wherein the fastener **82**

extends across the slot **78** formed in the upper portion of the lateral portion **74**. The fastener **82** may tighten or loosen the grip of the lateral portion **74** of the primary shaft **72** on the intermediate shaft **80**. The intermediate shaft **80** is integrally connected to a secondary shaft **84**. The secondary shaft **84** has a longitudinal axis that is substantially perpendicular to the longitudinal axis of the intermediate shaft **80** and substantially parallel to the longitudinal axis of the primary shaft **72**. The loose end of the secondary shaft **84** has the substantially squared configuration with a spring detent **46** formed therein for receiving a socket **48**, as previously described in the first embodiment.

Yet another way to provide an adjustable connection to the tooling apparatus **10** is shown in Figs. 7-8 as a fifth embodiment of the present invention. A primary shaft **86** provides the knurled portion **37** which acts as a handle, as previously described, and the threaded portion for threadably receiving the bearing member **36**. The pair of jam nuts **42** may secure the bearing member **36** onto the primary shaft **86** in a predetermined position relative to the primary shaft **86**. The primary shaft **86** provides a T-shaped configuration wherein a lateral portion **88** of the T-shaped configuration has a rectangular configuration with a substantially rectangular throughbore extending therethrough along a longitudinal axis of said lateral portion **88**. An intermediate shaft **90** having a substantially rectangular cross section is inserted into and received by the rectangular throughbore in the lateral portion **88** of the primary shaft **86**. A set screw **92** threads into a threaded aperture provided in the top wall of the lateral portion **88**. The set screw **92** has its end engage the intermediate shaft **90** so as to secure the intermediate shaft **90** in a predetermined position relative to the lateral portion **88** on the end of the primary shaft **86**. A secondary shaft **94** is integrally connected to the intermediate shaft **90** and has a longitudinal axis that extends at a substantially right angle to

the longitudinal axis of said lateral portion **88** and substantially parallel to a longitudinal axis of said primary shaft **86**. The loose end of the secondary shaft **94** has the substantially squared configuration with a spring detent **46** formed therein for receiving a socket **48**, as described in the first embodiment of the present invention.

In order to engage all of the brake drum bolts **12** at one time, Fig. 9 shows a sixth embodiment utilizing five intermediate **98** shafts on a single primary shaft **96**. The primary shaft **96** has the knurled portion **37** which acts as a handle and a threaded portion for threadably receiving the bearing member **36**, as previously described in the first embodiment. Jam nuts **42** may be utilized to secure the bearing member **36** in a predetermined position relative to the primary shaft **96**, as also previously described. The end of the primary shaft **96** provides a threaded stud **97** formed thereon. Five flat intermediate shafts **98** having an aperture extending therethrough are received by the threaded stud of the primary shaft **96**. A nut **100** is threaded onto the threaded stud of the primary shaft **96** thereby securing the intermediate shafts **98** into a predetermined position corresponding to the configuration of the brake drum bolts **12**. Each of the intermediate shafts **98** have an integral secondary shaft (not shown) extending at an angle substantially perpendicular to the intermediate shaft **98** and substantially parallel to the longitudinal axis of the primary shaft **96**. Each of the secondary shafts has a substantially square end formed therein wherein the spring detent **46** is formed therein for receiving a socket **48**, as described in the first embodiment of the present invention.

In order to provide rotational adjustment of the socket **48** onto the nut **15** of the brake drum bolts **12**, Fig. 10 discloses a seventh embodiment of the tooling apparatus **10**. A primary shaft **104** has a knurled portion **37** for forming a handle and a threaded portion formed thereon for threadably receiving the bearing member **36**, as previously described. The jam nuts **42**

secure the bearing member **36** onto the primary shaft **104** in a predetermined position, as also previously described. The primary shaft **104** provides a T-shaped configuration wherein the lateral portion **106** of the T-shaped configuration provides a threaded throughbore having a longitudinal axis substantially perpendicular to the longitudinal axis of the primary shaft **104**. An intermediate shaft **108** has a threaded end **107** that is threadably received by the threaded throughbore in the lateral portion **106** of the primary shaft **104**. A pair of jam nuts **110** are threaded onto the threaded portion of the intermediate shaft **108** on both sides of the lateral portion **106** to secure the intermediate shaft **108** into a predetermined position relative to the primary shaft **104**.

The other end of the intermediate shaft **108** has a smooth diameter throughbore for receiving a smooth outer diameter of the secondary shaft **112**. The secondary shaft **112** has a T-shaped configuration wherein the lateral portion **113** of the T-shaped configuration extends just above the intermediate shaft **108**. A pair of diametrically opposed dowel rods **114** extend from the intermediate shaft **108** and act as positive stops to the lateral portion **113** of the T-shaped secondary shaft **112**. The lateral portion **113** of the T-shaped secondary shaft **112** is positioned between the dowel rods **114** such that the secondary shaft **112** is allowed a limited degree of rotational movement for adjusting the socket **48** relative to the nut **15** of the brake drum bolts **12**. A compression spring **116** is mounted on the secondary shaft **112** just below the intermediate shaft **108**. A small shoulder **118** is formed on the secondary shaft **112** to support the lower portion of the compression spring **116**. The upper portion of the compression spring **116** engages the underside of the intermediate shaft **108**. The compression spring **116** biases the secondary shaft **112** downward such that the lateral portion **113** of the T-shaped configuration of the secondary shaft **112** may engage with the dowel rods

114. The end of the secondary shaft **112** has a substantially square configuration with the spring detent **46** formed therein for receiving the socket **48**, as previously described in the first embodiment of the present invention.

In operation, as shown in Figs. 1-2 of the first embodiment, the user or mechanic inserts the handle portion **32** of the primary shaft **26** through the hole or bearing face **24** of the truck or trailer wheels **14**. The handle portion **32** of the primary shaft **26** remains on the second side **34** of the wheels **14**, and the socket portion **52** of the tooling apparatus **10** remains on the first side **22** of the wheels **14**. The proper-sized socket **48** for the nut **15** of the brake drum bolts **12** is determined by the mechanic and is attached to the spring detent **46** on the end of the secondary shaft **30**. The bearing member **36** is wedged into the hole or bearing race **24** provided in the wheel **14**, and the socket **48** is placed on the nut **15** of the brake drum bolts **12**. If the socket **48** does not fit on the brake drum bolts **12**, then the bearing member may be threadably adjusted along the primary shaft **26** to properly fit the socket **48** on the brake drum bolts. Once the bearing member **36** is properly adjusted, the mechanic stands on the second side of the wheels **14** and grasps the handle (knurled portion **37**) of the primary shaft **26**. The mechanic then utilizes an air ratchet or wrench to engage and loosen the bolts **13** of the brake drum bolts **12** on the second side **34** of the wheels **14**. Once the brake drum bolts **12** are loosened, the mechanic moves to the first side **22** of the wheels **14** and places the socket **48** on a different nut **15** of the brake drum bolt **12**. The process is repeated until all the brake drum bolts **12** are removed. A reverse procedure may be utilized to tighten the brake drum bolts **12** onto the brake drum **20**.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is

not to be limited to the disclosed embodiments, but to the contrary, it is intended to cover various modifications of equivalent arrangements included within the spirit and scope of the appended claims. The scope is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures as is protected under the law.